Yusuf Mohamed Mubarak

Mobile Networks Evolution in East-Africa

Opportunities and Challenges in Mobile Networks in Kenya and Somalia

Helsinki Metropolia University of Applied Sciences

Master's Degree

Information Technology

Master's Thesis

19 November 2017

Helsinki Metropolia University of Applied Sciences

Preface

First, I would like to express my gratitude and thanks to the Almighty God who made it possible for me to complete the thesis. For me, writing the thesis was an inspiring opportunity which enabled me to accomplish my goal of completing the Master's Degree in Information Technology at Helsinki Metropolia University of Applied Sciences. For me this was also an excellent continuation to my Bachelor's Degree in Electric and Telecommunications Engineering gained from there in 2001. This study has been an important learning journey which has enabled me to increase my knowledge and skills regarding Information Technology. With respect, I would like to thank all of those who have helped me in achieving my goals to complete the study.

Furthermore, I would like to express my thanks to those who have participated in the research interviews as well as the information gatherings. Moreover, I would like to thank my family and close friends for their encouragement and support. Finally, I would like to express my gratitude and thanks towards my instructor Ville Jääskeläinen at Metropolia and the teachers for their magnificent work in the Master's Degree program.

Helsinki, 19 November 2017
Yusuf Mohamed Mubarak

Abstract

Author(s) Title Number of Pages Date	Yusuf Mohamed Mubarak Mobile Networks Evolution in East-Africa Opportunities and Challenges in Mobile Networks in Kenya and Somalia 53 pages + 3 appendices 19 November 2017
Degree	Master's Degree
Degree Programme	Information Technology
Instructor(s)	Ville Jääskeläinen, Principal Lecturer

The research topic of this thesis is Mobile Networks Evolution in East-Africa, in particular Kenya and Somalia. The research focus is the relative performance of the mobile sector in these countries, and the underlying drivers of performance. This master's thesis was written for Nokia, for Metropolia University of Applied Sciences, and all others interested in the topic.

The motivation for this Master of Science in Engineering began with discussions with Nokia employees who had visited Kenya between 2010-2013. These Nokia employees had an assumption from their findings that networks in East Africa, including Kenya and Somalia, were several years behind compared to those in developed countries such as Finland. Hence, the thesis research investigates the reasons why the networks have been lagging behind. In particular, the thesis research investigates whether there are any possible political, economic, social or technological factors that could affect the development of the networks. The study is based on using various information sources such as questionnaires and interviews, as well as review of articles, reports, web sites etc. The research outcomes are recommendations for mobile network vendors, operators, scholars, students as well as for other researchers.

Keywords	2G, 3G, 4G, LTE, M-PESA, PEST, HDI, SDGs, GDP, UNDP

Contents

References and appendixes

List of figures

List of tables

ABBROVIATIONS/ACRONYMS

GSM	Global System for Mobile Communications
1G	First generation (mobile networks)
2G	Second generation (mobile networks)
3G	Third generation (mobile networks)
LTE	Long-Term Evolution (4th generation mobile networks)
4G	Fourth generation (mobile networks)
WCDMA	Wideband Code Division Multiple Access
M-PESA	M-Pesa is a mobile money transfer service
QoS	Quality of Services
PEST	PEST analysis (Political, Economic, Social, Technological)
Gbps	Giga bits per second
Kbps	Kilo bits per second
Mbps	Mega bits per second
HDI	Human Development Index
GDP	Gross Domestic Product
GNI	Gross National Income
EVC	Electronic Voucher Card (a mobile money application)
OTT	Over-The-Top
UNDP	United Nations Development Program
SDG	Sustainable Development Goals

1 INTRODUCTION

This Introduction chapter first describes the motivation, research background and objectives of the study. After that the used methods, material and limitations are described.

1.1 Research Background and Objectives

The background of this research starts from an assumption of colleagues from Nokia having visited Kenya in 2013. During their trip to support one of Kenya's operators, they realized that Kenya's mobile networks infrastructure needed a major renewal regarding both the radio and core network. The discussions with the engineers ignited an interest to do the present research. The research investigations concerns two issues that could have an impact on the network status in Kenya and Somalia. The first one is the technological advances of these countries and the second one is the social development impacts of the target countries. These two are kept as interdependent factors, both possibly affecting the technological advances in their networks.

As a sector, Africa's mobile industry has been growing rapidly during the past two decades. The sector has been creating millions of new jobs on the continent, particularly in mobile networks infrastructure renewing and service delivery. Regarding the continents' mobile networks evolution, it is apparent that Kenya and Somalia are countries that have performed better than some others in the region. Seemingly, Kenya was doing extremely well compared to many other African countries. This was due to the fact that as a country Kenya was relatively safe and their telecom sector's regulations were in a better shape compared to many other countries in Africa.

Concerning Somalia, which is a neighbour to Kenya, the situation was more challenging compared to Kenya's. Somalia has been experiencing insecurity and political instability during the past two decades due to civil wars and political divides. From 2008, after a political process, Somalia has started to recover and has been making progress both politically and economically. Despite challenges, Somalia's telecommunications sector has achieved huge development and advances. Somalia´s telephone call prices are among the cheapest in Africa and mobile money has been booming.

This is despite the tough times when the country was dependent upon its Diasporas remittances. Somalia's telecom sector was filling the financial services vacuum caused by the civil war and the loss of conventional banking (World Development Report 2016).

In the case of Kenya, mobile networks have been making advances on various fronts. One major developmental factor in Kenya's mobile market was in the service delivery where, for instance, mobile money applications like M-PESA have been doing extremely well. The application has been noticed around Africa and around the world as being among the first major mobile money applications in the market. The usage of such services has been expending and other mobile payment methods such as Airtel Money, Orange Money, Equitel Money, Mobikash and Tangaza have been emerging in the market. In Kenya many businesses, hotels, restaurants, taxis etc. have been accepting mobile money payments for a time (Communication Authority of Kenya 2016).

Concerning Kenya's rural community development, mobile money has been a key for their livelihoods and a key to having access to banking services. Additionally, mobile money has become a secure way of spending and keeping money compared to holding cash. In the past several years, mobile money has generated huge growth in East-Africa by creating new business models and agents. Other services making huge growth in these markets included high speed data connections as well as multimedia streaming and video calls. Also, the so called OTT (Over-The-Top) smartphone applications like Viber, WhatsApp and Skype usages have been increasing and taking revenues from operator's traditional voice and SMS services (World Development Report 2016).

Compared to Kenya's situation, Somalia did not have significant telecom laws before 2012 when the country's first national communications act was introduced. In August 2017 the country's parliament approved the first inclusive ICT and telecommunications acts. The implementations of those laws are expected to give the sector some significant improvements. Further to the above, the aim of the research will remain to investigate market dynamics as well as challenges and opportunities in both countries (World Development Report 2016).

The research objectives of this thesis are as follows:

- To investigate what factors are causing mobile networks to be lagging behind in Kenya and Somalia and the subsequent consequences.
- To discover what, if any, political, economic, cultural, social or technological factors could be causing this lagging behind.
- To introduce some conclusions and recommendations from the findings.

1.2 Research Methodology

The research was conducted from both a qualitative and quantitative point of view. The data collected was generated via a main questionnaire comprising eight questions that was sent to two operators - one in Kenya and one in Somalia. This was followed by interviews. Additionally, other materials listed below were used to answer the research questions:

- Reports, researches, articles, websites, online documents, books etc.
- Conclusions based on discussions held with two scholars from each country, ten service consumers from each country on my trips to Kenya and to Somalia.
- Personal views and experience from Kenya and Somalia.

In December 2013 a trip of two weeks was made to both countries for information gathering. During the information-gathering period, it was a privilege to meet the countries' mobile operators' representatives and conduct interviews based on the questionnaire. The queries asked in the questionnaire had been set to give some basic information about the network's status as well as to get some answers for the research question of why these networks have been lagging behind.

From the service consumer's perspective, ten people from each country were asked 3 basic questions related to services and networks availability. These questions were set to give some basic information of the consumer's behaviour to the services point of view. Likewise, it was important to know what mobile operator services they found important, how important have mobile phones been for their daily life, and how they see the development of the mobile services and the market.

In order to gain further insight, two scholars from each country were interviewed and discussions were held about the country's mobile networks developments. The views of the scholars have been important to delve more into the social development and trends related to mobile services and market dynamics as well as the opportunities within.

In relation to the research framework, the boundaries were limited to the following:

- Findings based on questionnaires sent to two operators
- Findings based on interviews with two scholars and 10 service consumers from each country
- Findings based on researches, reports, articles, online documents, institutions documents, books and other internet sources in addition to findings based on figures, tables and indicators from the topic areas
- The research does not include testing outcomes and results, numeric or mathematical models or proofing.
- The research focuses on the boundaries of PEST (Political, Economic, Social and Technological), an analytical framework looking at the topic from these factors' point of view.
- The research outcomes contain an entity of analysis, recommendations and conclusions based on the research observations.

The research outcomes and data gathered from various resources are presented as the basis for subsequent conclusions. The validity and reliability of the research is supported by the combination of quantitative and qualitative research findings as well as reports and figures related to target countries. Below, Chapter 2 introduces the research tools selected for the study as well as some observations of the research.

2 PEST Analysis Method

This chapter describes the Political, Economic, Social and Technological (PEST) analytical framework and how it was used in the present study. Additionally, it provides more details about the selection of the analysis tool.

2.1 PEST Analysis

During the first phases of the research, it was important to select a tool for the research. After some studies and having looked at several methods, it became clear that the PEST analysis method was most reliable for the study. The PEST analysis method is a well-known framework used by many researchers and it defines analysis on the target research from several factors - political, economic, social and technological. Furthermore, it showed that PEST enables one to analyse the collected data and draw conclusions from it. With PEST analysis it is also deemed to be practicable to look at what kind of trends, advances, boundaries, limitations or opportunities and developments exist in the researched topic (MindTools 2017).

Moreover, it is important to investigate whether there are other possible reasons which could cause networks in Somalia and Kenya to lag behind. It is a fact that any mismanaged network or old infrastructure with no upgrades, not enough capacity and radio or frequency planning could end up lagging behind and not delivering expected services.

The case of Somalia and Kenya was not in such a situation as the networks have been delivering adequate services. Rather, the case was that Nokia employees' visits to Kenya have revealed some concerns about the capacity and radio coverage related to an old technology scenario. Figure 1 below shows the four major factors of PEST analysis with some key content. Some of the contents in the factors are analysed later in the research (Abhijeet, Pratap - Telecom Industry PEST/PESTAL analysis 2017; CrackMBA 2017).

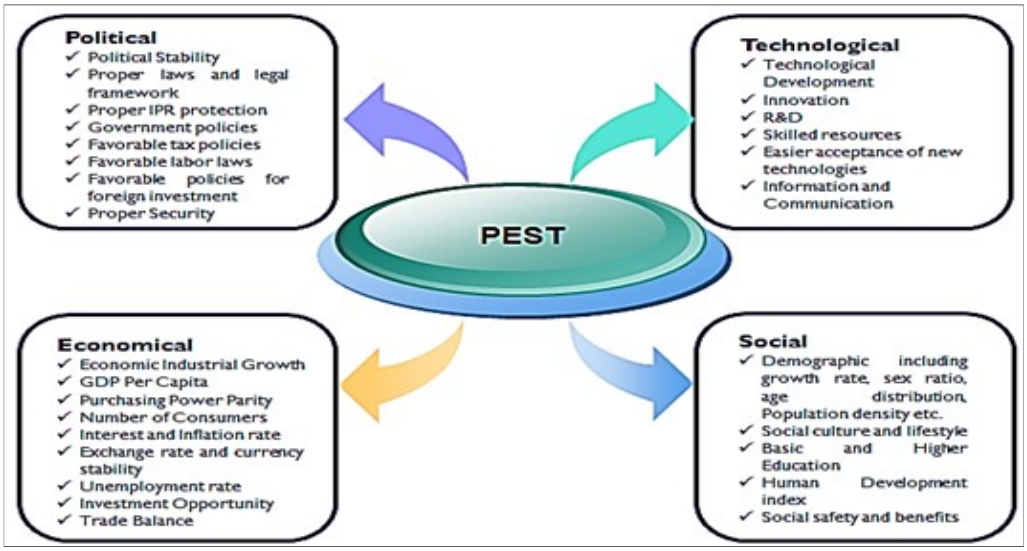


Figure 1. PEST Analysis Factors. (CrackMBA 2017)

In respect to development, developing countries' economic growth and technological know-how is quite different from those in developed countries. On the other hand, when it comes to development, it is obvious that the developed countries have had a long history of technologies and the telecommunications infrastructure development for instance. By contrast, developing countries still cope with patchy ICT infrastructure, modern technologies' adoption challenges, rural communities' developments as well as poverty reduction measures in their communities.

The challenges exist in many developing countries related to living standards, community's possibilities of participation to services such as education, clean water, health and livelihoods and income generation vary in many developing countries (World Development Report 2016).

As a conclusion to above, the factors of political, economic, social and technological consequences, which could cause possible lagging behind, will be examined in Chapter 3 of the research. Moreover, the next chapter summarizes the evolution of mobile networks in Africa, particularly in Kenya and Somalia. The chapter summarizes the developments, challenges and opportunities of the sector.

3 MOBILE NETWORKS EVOLUTION

The chapter briefly summarizes the mobile networks' evolution as well as technology milestones on a global scale. It also introduces the current situation, challenges and opportunities of mobile networks' in Kenya and Somalia.

The history of mobile networks started almost three decades ago in Europe, USA and in Japan. The technological development, standardization steps, new services and features developments have been tremendous. In parallel to technological developments, new features offering new services have been merging into the markets from time to time. Operators around the world have been gaining high revenues from the mobile network service deliveries and additionally new businesses have been evolving. Figure 2 below indicates the evolution of mobile networks from 1G to 4G LTE. See also Appendix 1 for more information about mobile networks specifics (Understanding 5G 2014).

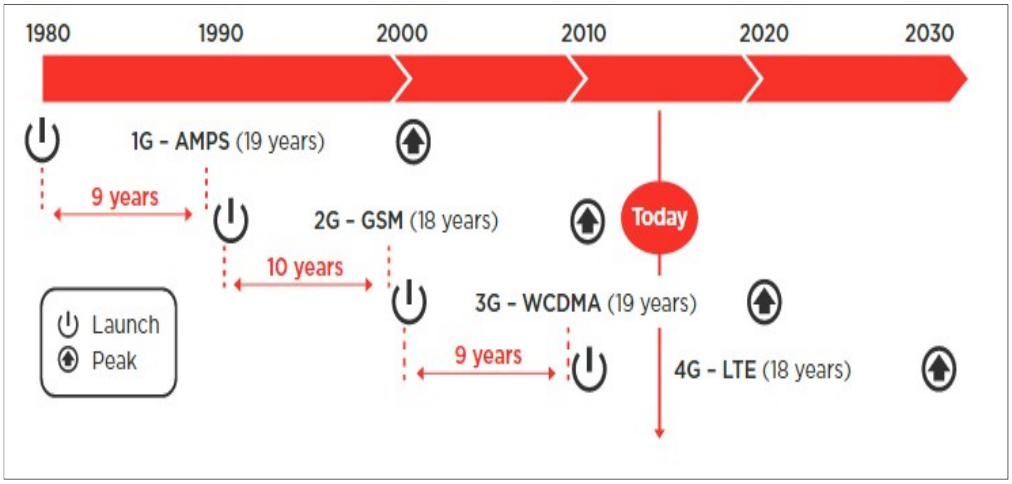


Figure 2. Mobile Networks Evolution. (Understanding 5G 2014)

On a global scale, the Mobile networks have experienced a rapid technological breakthrough and growth in the last two decades. In 1985 the situation was quite silent compared to today. Nowadays, mobile networks and mobile phones have spread worldwide and without them everyday life may become difficult in countries/economies that are so dependent on internet and mobile services. Figure 3 below demonstrates the global mobile systems technological development in recent years. The figure shows that the 3G networks were increasing steadily, while the 4G was expending and, in reverse, 2G networks usage are declining (The Mobile Economy 2017).

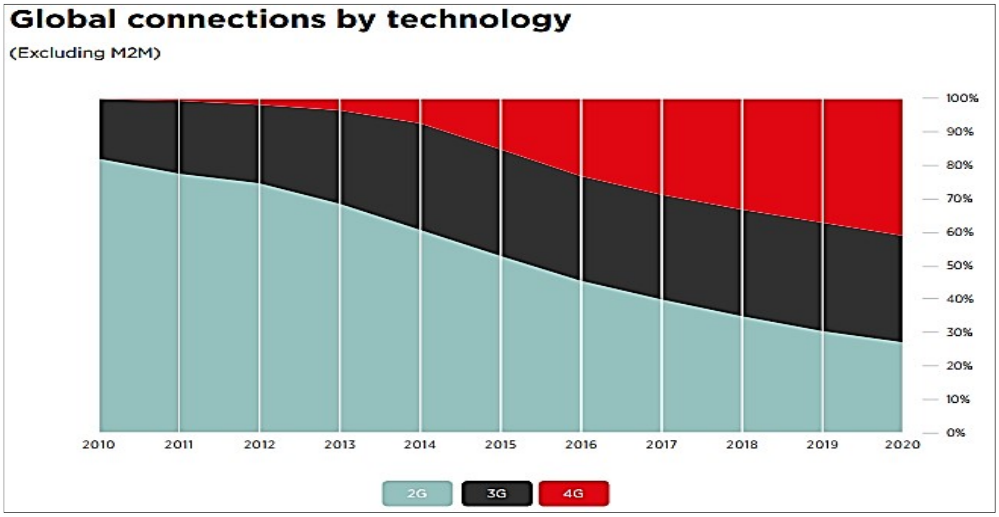


Figure 3. Global Connections by Technology. (The Mobile Economy 2017)

Moreover, mobile networks have become an important part of many economies and mobile phone usage an important part of current lifestyle for many people. For many developing economies, mobile networks revenue, employments, innovations and services contribute hugely to their economy, prosperity and development. While traditional services like voice and SMS remain popular, services such as accessing the internet have become common (The Mobile Economy 2017). Figure 4 below shows the developments of mobile connections in Africa from year 2000 of 17 million of users to year 2015 of 906 million users, this reveals a robust increase. The trend is expected to continue increasing and to strengthen in the future (Aviat networks 2017).

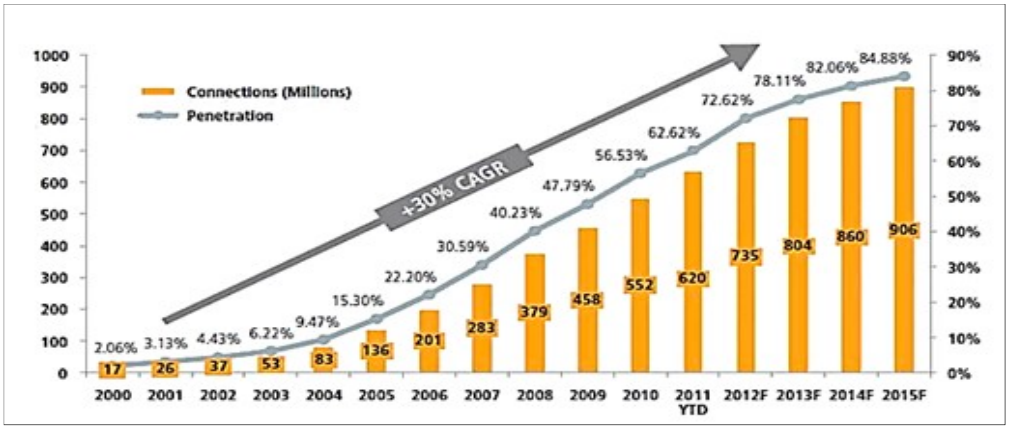


Figure 4. Africa's Mobile Connections Growth. (Aviat networks 2017)

Figure 4 also demonstrates a remarkable fact that in 2000 the penetration of Africa's mobile networks had been just 2.06% while in 2015 the figure was 84.88%. This shows a remarkable progress and growth within one and a half decades. Due to the huge advancement of the mobile network technologies, more and more highly advanced and enhanced services and applications have been introduced to consumers. Services such as IP-based mobile TV, mobile banking, which is a hot potato in developing countries, as well as many e-services including e-commerce, e-health and many other services have become available in many countries. The trend is expected to continue and this holds also a huge opportunities to software companies as well as to network vendors (Aviat networks 2017).

In 2016 the number of mobile users was 4.8 billion (55%) from the global population. By 2020, it is projected to reach 5.7 billion (73%). SIM connections are also predicted to increase from today's 7.9 billion to 9.7 billion by 2020. In the same report the contribution of mobile networks to economic growth and social development across the globe was reported as being remarkable. Below are some figures and examples from the influence of the mobile networks (The Mobile Economy 2017).

Digital inclusion predicted

- Delivering digital inclusion to the still unconnected populations was reported to be 48% in 2016 and predicted to increase to 60% by year 2020 (The Mobile Economy Africa 2016).

  "Digital inclusion – defined here as the expansion of global connectivity and mobile internet adoption – can extend various economic and social benefits to previously unconnected populations, fueling a virtuous circle that reduces poverty, improves infrastructure and services, and further increases internet access and usage." Quoted from (The Mobile Economy Africa 2016).

The ICT and digital literacy are as well important factors needed to being addressed and improved in Somalia and in Kenya as well as in the developing countries. The report quoted above indicates the below four challenges that the mobile ecosystem and associations like GSMA addresses particularly in the Africa and mainly in the developing world:

- Networks coverage
- Affordability
- Digital skills and awareness
- Locally relevant content

Financial inclusion predicted

- Delivering financial inclusion to the unbanked populations was reported to be for instance 277 mobile money applications in service globally around 92 countries in 2016. This is expected to increase in the future (The Mobile Economy Africa 2016).

Innovation scope predicted

- Delivering innovative new services and applications. The number of M2M (machine to machine connections) are predicted to reach 1 billion by 2020 (The Mobile Economy Africa 2016).

In Africa, limited network access coverage remains a key barrier to mobile internet adoption. Currently, the mobile broadband networks cover approximately 50% of the population, meaning that 600 million people in the region do not have access to mobile broadband services. In Kenya the number of people within the mobile broadband access coverage has risen from 7.2 million in 2015 to 12.7 million in 2016. In Somalia the mobile broadband coverage has been reported in 2016 to be only 1%. The sector offers vast possibilities for investments and possible partnerships (Mobile Economy, 2017).

Furthermore, in the digital revolution era, 5G is expected to offer more data speed of gigabits, and wireless connections are expected to grow faster. 5G technology is expected to offer more capability and more advanced new services. In this interesting development, the internet of things is expected to enable new innovations and domestic appliances to be controlled from mobile phones via the internet. This coming new services of 5G will create, in both the developed and developing world, a huge opportunity for operator businesses, for agents and for consumers.

For instance the 5th generation networks are predicted to be taken into use in Africa 5 years behind South Korea, Japan and Europe, which are predicted to be taken into use by 2019-2020. This prediction is again a finding that the continent is predicted to be behind in technological advances; the predicted five years is in line with what Nokia employees in 2013 considered to be valid (The Mobile Economy in Africa 2016).

As a conclusion to the above, it is apparent that mobile networks have massive social and economic developmental effects. In Somalia and Kenya networks developments started a decade and a half ago as of many of the developing countries and developments continue. The performance and steps taken have been in accordance with the development of these countries. In this respect it is obvious that networks are affected by the overall development of the country, the economic situation as well as all aspects related to society's ability economically. Notably, also neighboring countries Ethiopia and Djibouti networks are still under a monopoly, and from this perspective both Somalia and Kenya are in an advantageous position (The Mobile Economy in Africa 2016).

During the investigation one of the operators interviewed said that while one has a low income and mainly serving a poor population, with vast unemployment, challenges related to daily life etc. it is not easy to make huge investments to the networks. One needs to know that the investments will make a profit; furthermore, one needs to pay profits to the shareholders. In this case, it is very difficult to follow technological advancements - one must skip some upgrades and make some savings and invest only when absolutely necessary (Personal encounter 10 Oct 2017).

3.1 Mobile Networks Evolution in Kenya and Somalia

Prior to introducing Kenya and Somalia telecom industry's challenges and opportunities later in this chapter, here below is a geographical introduction of these neighboring East African counties. Figure 5 below indicates basic geographical data of both countries (Country Economy 2017).

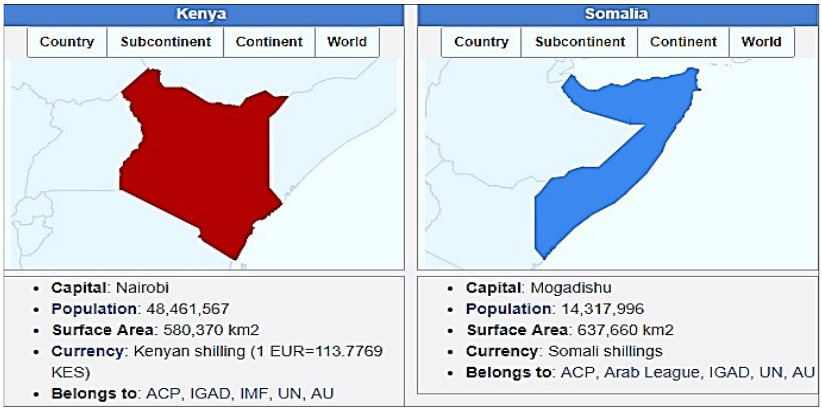


Figure 5. Somalia and Kenya Country Data. (Country Economy 2017)

Both countries are developing economies having both challenges and vast opportunities. When looking at some development figures, for instance the human development index, which shows the countries' life expectancy, knowledge and living standard, Kenya is ranked to 0.470 while Somalia's index is 0.285 in comparison to Finland which is ranked 0.889. The figures of human development index demonstrate a specific country's status of development, the closer the figure is to 1 the better the development status (Country Economy 2017).

Technologically, since mobile networks became commercially available in the late 1980s, Somalia has advanced well in terms of services, technology, handsets as well as affordability. In relation to mobile networks developments, the most revolutionary change has happened in the space of the last two decades, when mobile subscribers surpassed fixed-telephone line subscribers in 2002, making mobile technology the predominant means of voice communications (ITU 2016).

Globally, as well as in Africa and in Kenya and Somalia, mobile ecosystems have become a major economic pillar to a country's finance and revenues. The following Figure 6 has been reported by GSMA mobile economy in its 2016 report (The Mobile Economy Africa 2016). Mobile ecosystems' contribution to public funding (before regulatory and spectrum fees) was reported in 2016 to be 450 billion USD and it is predicted to increase in the future (The Mobile Economy Africa 2016).

Furthermore, the employment impact of jobs directly and indirectly supported by the mobile ecosystem has been reported as 28.6 million jobs worldwide, a huge number indeed. The increase of subscribers has also been growing fast. Figure 6 below indicates the situation of mobile subscribers in the recent years in Africa compared to global numbers, both in terms of penetration and unique subscribers' point of view (The Mobile Economy Africa 2016).

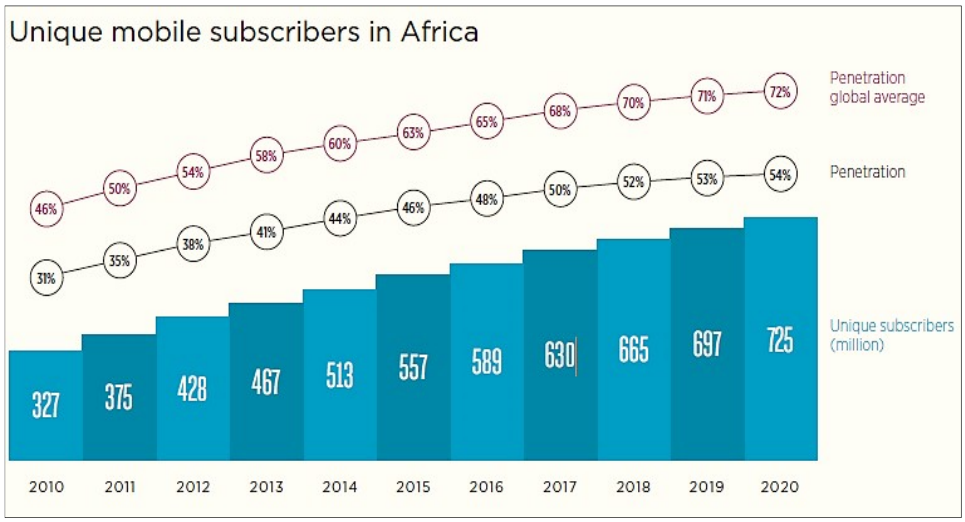


Figure 6. Mobile Subscribers Worldwide. (The Mobile Economy Africa 2016)

The mobile economy report in 2016 and the figure above indicate that Africa had 589 million subscribers with a penetration of 48% in total. While the global numbers of penetration were 65% in this respect Africa was lagging behind by 17% from the world average, which is a significant difference (The Mobile Economy Africa 2016).

The global network evolution has been driven by demand and services both in Kenya and in Somalia; this is expected and predicted to continue with increasing speed. Considering Kenya's global economy development figures as well as the country's mobile networks progress, Kenya was among the best growing economies in Africa. The average annual growth rate of Kenya was over 5% for recent years (World Bank, 2016, 2017). In terms of development, Kenya was ranked 145 in 2015, while for comparison Finland, which is a developed country, held position 24 among the global data of 180 countries. As with many developing countries, Kenya has also had its own country political, economic, social and technological challenges (Kenya Economic Outlook, 2016; World Bank 2016).

Mobile networks have been seen as a significant contributor in reducing poverty in developing communities. The UN sustainable development goals (SDGs) for 2030 Appendix 2 the 17 point goals act (from ending poverty in all its forms everywhere to strengthening the means of implementation and revitalizing the global partnership for sustainable development). SDG's are aimed as a guide for developing countries for the journey to reduce poverty and improve their economies and social well-being as well as to catch up with other countries on the development scale (UN 2017).

For Africa and for Kenya and Somalia, mobile networks have been transforming communications and communities lifestyle in ways which are remarkable. Mobile Networks services have become affordable to many low-income families and become as an easy way of communication. It has also made it possible for many to create their own business and incomes, mobile money agents and service resellers create major markets in these countries (The Mobile Economy Africa 2016). For example, when starting the present study at the end of 2013 the 2G based technologies were the dominant technology in both Kenya and Somalia. The 3G was in a limited use in Kenya and under planning in Somalia. At the same time, in Finland and in many developed countries 3G was very popular and 4G was being tested. From this perspective it is obvious that the networks in both Kenya and Somalia have been lagging behind for at least several years compared to Finland.

In conclusion, the lagging behind of these markets compared to other developed countries like Finland could also be approximately five years. With respect to adapting from 2G to 3G the gap was nearly 5 years. But in terms of adapting from 3G to 4G the gap was closer to about 1-2 years. Both operators in Somalia and in Kenya were offering 3G services in 2014 and some 4G services from 2015.

Furthermore, in 2016 Kenya's mobile networks as well as in Somalia 3G services were available in major cities and 4G services were available in some cities. For instance, Safaricom, one of the dominant operators in Kenya, was offering 4G-based fast data connection to the six largest cities in Kenya.

Figure 7 below summarizes Kenya's mobile market status in 2016. It is obvious that this vast market of over 47 million consumers holds huge opportunities for investment and partnerships (Safaricom, 2016).

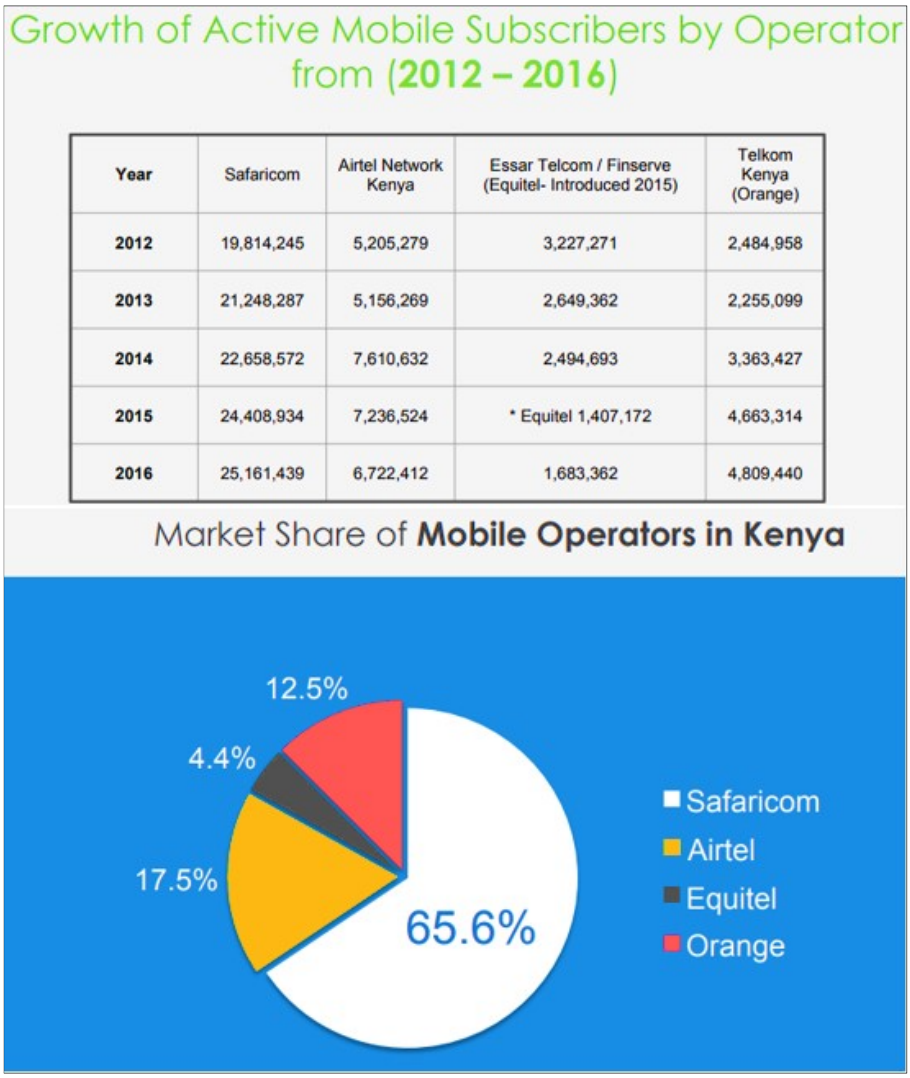


Figure 7. Kenya Mobile Networks Market. (Twinpine network 2016)

In the Kenya telecom market, Safaricom was a major market dominant for years whereas Airtel, Orange and Equitel have been holding their own positions. In 2015, Safaricom renewed its networks with some 500 radio stations to improve its network's coverage, capacity and service quality (Safaricom 2016).

Safaricom was making market records on its mobile data revenue in 2016; and the company has reported revenue growth of 59% in that service delivery. They have also reported mobile data growth of 21% compared to the previous year. One of the main drivers of Safaricom's market dominance has been related to its M-Pesa mobile money since 2007. In 2014, M-Pesa had market dominance in Kenya's mobile money with 20 million customers out of the 26 million mobile money customers in Kenya (Safaricom

News Release, 2016).Figure 7 also shows Kenya's mobile operators' market shares (Twinpine network 2016). See Appendix 3 for more information and comparison from Somalia and Kenya telecommunication sector.

Obviously in near future, the growing consumer demands in these countries will lead operators to upgrade their networks. Moreover, it is obvious that operators will need to invest more and expand services to increase revenues and reach new subscribers. Figure 9 illustrates the situation of 2G, 3G and 4G telecom markets; it indicates that 4G will continue to grow in the near future (Africa Market Outlook, 2015). Figure 8 for instance, that the 2G networks services will decline in the future as more advanced networks are taken into use (Africa Market Outlook 2015).

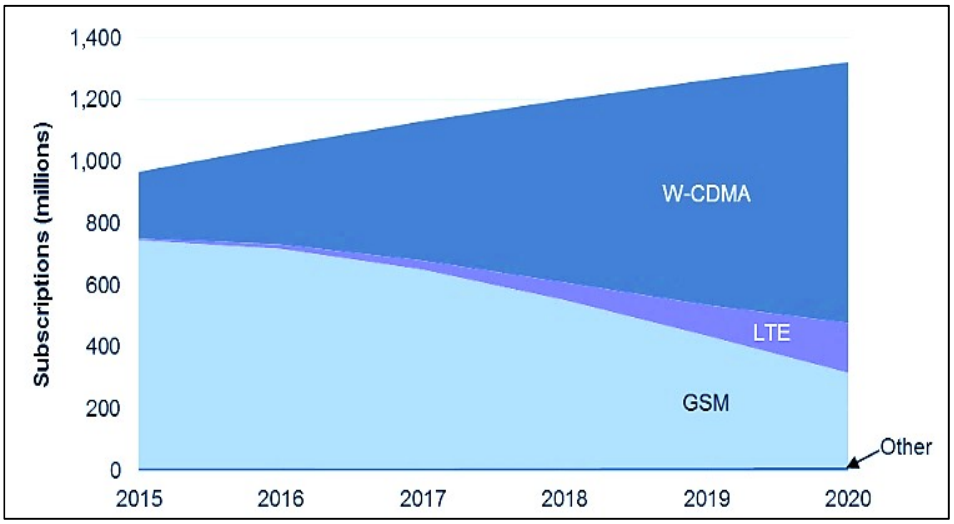


Figure 8. Africa Mobile Subscriptions. (Africa Market Outlook 2015)

From an economic perspective Somalia's mobile market holds huge opportunities for the coming years as it will need heavy investments and expansions. Internet services deployments and broadband connections will also over possibilities and investments. Although Somalia was recovering from years of economic, social and political challenges, the country's telecom sector was making a growth and it is promising also in the future (The Mobile Economy Africa 2016).

Many analysts believe Somalia's telecom sector to have saved the country from economic chaos during the lack of government institutions and banks in the civil wars of the 1990s (The Mobile Economy Africa 2016). Somalia's telecom market was dominated for years by seven operators.

Somalia's mobile operators have been offering various services. However, the absence of regulations and control as well as proper taxation has led to difficult challenges on frequencies and spectrum management and coordination's. Also, internal roamings have been a major problematic issue for a time. The new telecom acts are expected to bring some resolutions and guidelines for challenges that the sector faces today.

Somalia's Internet Service Providers (ISPs) have been able to provide improved services, though international bandwidth remains very limited due to limited international fibre connections to the world. This is expected to change when more submarine cables are taken into us in future years. The 1,500km G2A cable (with a terrestrial connection to Addis Ababa in Ethiopia), is expected to be ready for service at the end of 2018, and the 5,500km DARE cable, is expected to be available in May 2018 (Paul Budde, Research and Markets 2017).

Currently there are fibre-optic broadband links connecting Somalia across the Kenya border and connected into Hormuud Telecoms network, one of the main operators in Somalia and there has also been Dalcom undersea fibre connection. More undersea connections via sea are expected in the coming years as well as more players in the internet connections market. The Figure 9 below indicates Somalia's mobile market situation. However, a vast part of the country is not covered and much will need to be done in the coming years. (Paul Budde, Research and Markets 2017).

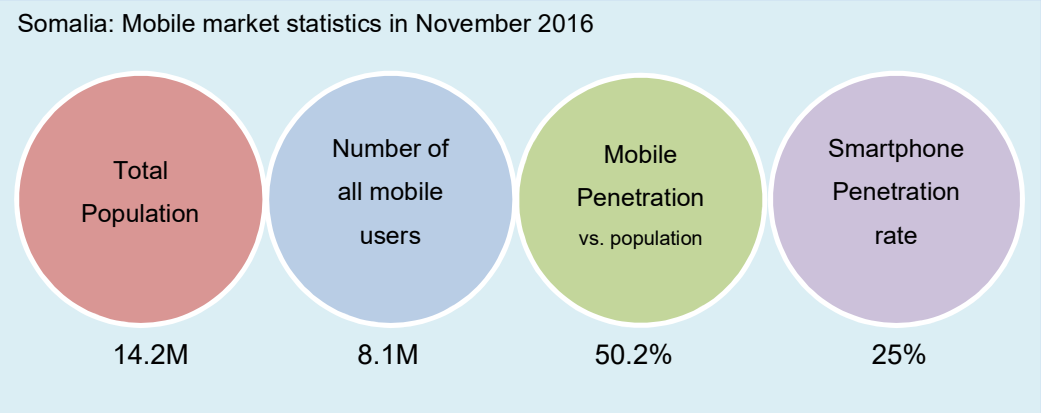


Figure 9. Somalia Mobile Networks Market, 2016. (The Mobile Economy 2017)

Moreover, Figure 10 below indicates Somalia's mobile networks situation in 2015 as well as the major mobile operators and market shares (Africa and Middle East Telecom-Week 2017).

The percentages as well market shared in accordance to 2015, the situation might have changes as well as percentages afterword's. More information about Somalia's operator's statistics as well as information could be accessed from GSMA reports as well as from World Bank and African Development Bank reports.

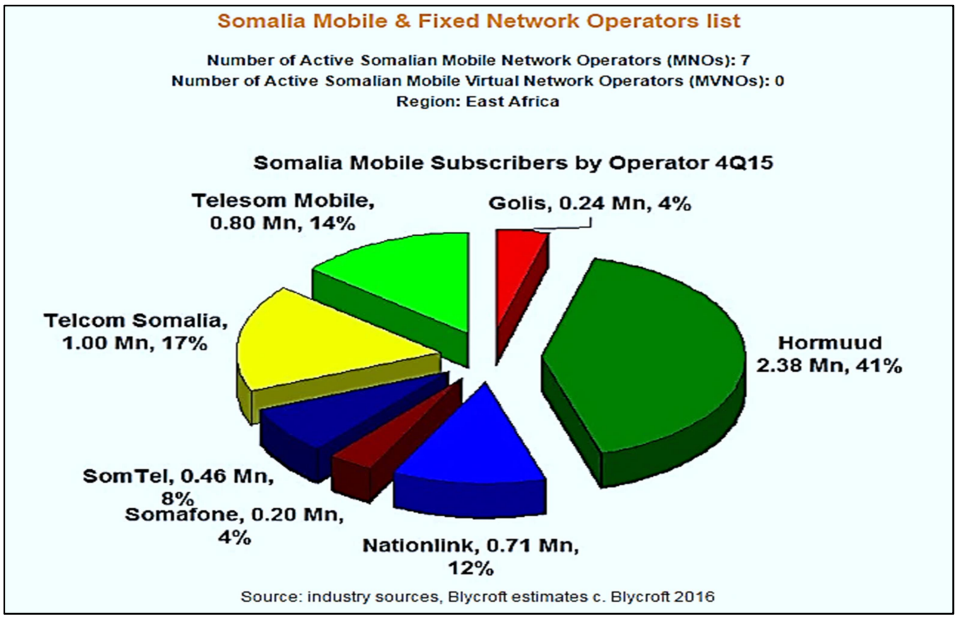


Figure 10. Somalia Mobile Operators. (Africa and Middle East Telecom-Week 2017)

Reports and researches from the World Bank, the Africa Market Outlook as well as the Mobile Economy reports and other analysis show that a country's developments depend much on its status on literacy or illiteracy, political, economic and social stability, on security and on how well the country is prepared for having a capacity for research and innovations. Furthermore, from the developmental figures' point of view, it is obvious that there is a significant interconnection between countries' development as well as access to technological advances and economic developments, growth etc. (Africa Market Outlook 2015; The Mobile Economy Africa 2016; World Development Report 2016).

The reports and figures indicate that Africa has been making progress but is behind in mobile networks developments on various fronts compared to other continents by

several years. This was obvious in terms of the penetration and subscriptions as well as the internet broadband services.

As a conclusion to the chapter, the findings from various sources indicate that Africa was largely behind on mobile networks development compared to the rest of the world. Similar trends can be seen also in both Somalia and in Kenya. As a positive development it is obvious that mobile money booms in both the countries. There has been also an increase in penetration and subscriptions and yet space to grow and make extensions. Figure 11 below shows some developments in both countries and their neighbours from past years related to subscriptions and mobile money (ITU 2016).

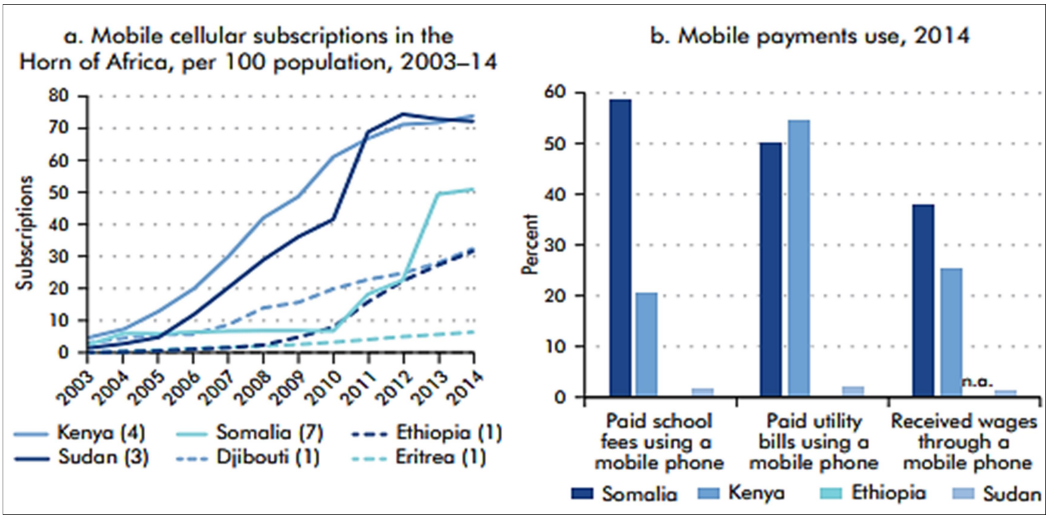


Figure 11. Mobile Subscriptions and Mobile Money Somalia and Kenya. (ITU 2016)

The figure above compares Kenya, Somalia, Ethiopia, Sudan, Djibouti and Eritrea mobile cellular subscriptions by population in 100 people. In 2014 Kenya and Sudan have been having over 70 subscriptions per 100 people, while Somalia has had 50 subscriptions per 100 people, Djibouti and Ethiopia have had 30 subscriptions per 100 people and Eritrea at lowest less than 10 subscriptions per 100 people. Moreover, mobile payments have been strong in Somalia followed by Kenya. In Sudan mobile payments show low marginal and in Ethiopia doesn't show in the scope of the mobile payments. (ITU 2016).

4 UNDERSTANDING KENYAN AND SOMALIAN ECONOMIES

The chapter introduces the Somalian and Kenyan economic situation which is also important to summarize for the research. The social and economic factors are important for the development as well as the political and technological ones.

4.1 Somalia and Kenya Developments

Somalia and Kenya are both growing neighbouring economies; these economies have some similarities in terms of social structures and community's living standards. Both countries have vast rural areas and nomadic populations. Furthermore, with regard to the political and economic landscape, Kenya has an influence on Somalia's economy as it holds a large active Somali community in Kenya due to Somalia's 1990's civil war. The economies of both countries mostly rely on agriculture and in Somalia also livestock, while in Kenya also on industry and services. Table 1 below summarizes some economic figures of Somalia and Kenya (UNDP, 2012-2016; World Bank, 2016).

Table 1.Human Development Indicators. (UNDP, 2012-2016; World Bank, 2016)

Indicators		**Kenya**	**Somalia**	**Year/s**
GDP - growth rate	The Gross Domestic Product measures the value of economic activity within a country. (%)	3.7	6	2016
HDI-index	Human Development Index measures life expectancy, knowledge and living standard	0.470	0.285	2012
Poverty rate	Population living below income poverty line (PPP $1.25 a day (%)	43.4	75	2014-2015
Mobile phone subs.	Mobile phones subscriptions (per 100 people)	73,8	50,9	2014-2015
Mobile operators	Mobile operators	4	9	2016
Internet use	Internet users (% of population)	43.4	1.6	2014-2015

For instance, UNDP (the agency of the United Nations for Development Programs) releases annually human development reports which show countries' status of developments as well as challenges they faced globally and progresses made in

previous years. Those reports indicate a significant lagging behind of Africa on a development scale compared to the developed world. The underdevelopment of the continent in various sectors reflects a slowdown in technological developments as well (UNDP, 2012-2016; World Bank, 2016). If one compares Somalia and Kenya to Finland which is number one in various developmental figures and ranks on Human Capital Ranking #1 while Kenya ranks in this specific rankings number 101 as Somalia's data have been missing. These figures show position those countries are in the global scale. Having noticed this and the challenges these countries face in various sectors, it is understandable that some retardment is obvious technologically (United Nations 2017; UNDP, 2012-2016; World Bank 2016).

Notably also mobile technology continues to play a central role in addressing a range of social challenges, including unregistered populations, the digital divide and financial inclusion. In September 2015, the UN introduced its Sustainable Development Goals (SDGs), a 17-point plan to end poverty, combat climate change and fight injustice and inequality by 2030. It is also expected that the mobile services will also alleviate poverty and contribute to ICT developments -(cf. Appendix 2). In accordance to the above findings mobile networks are part of technologies to promote and improve developing countries' developments both in technological advancement and accessing the internet (The Mobile Economy 2016).

In a significant manner the reports show that mobile networks are very essential to world development and for technological breakthroughs. The mobile economy report of 2017 predicts that the next generation mobile network 5G is expected to take-up first in the developed world. The technology is predicted to take 5 years to reach Africa before it may benefit its economy (The Mobile Economy 2017).

Table 2 below on the top barriers indicates the major issues that need to be addressed in the less developed countries. The following barriers have been introduced with regard to Kenya. These could also be mirrored to Somalia and to other less developed communities. These figures play a major in development not only technological wise but also on the sectors of society.

- Lack of awareness to local relevant content 46%
- Lack of digital skills and literacy 37%
- High cost of devices and services affordability 25%

The survey was done by the GSMA in 2015 and a thousand people selected from different parts of the society took part (Mobile Economy Africa 2016)

Table 2. Top Consumer Barriers to Internet Adoption. (Mobile Economy Africa 2016)

Top consumer barriers to internet adoption

Barrier	Lack of awareness and locally relevant content	Lack of digital skills and literacy	High cost of devices and services (Affordability)
Algeria	51%	23%	12%
Cameroon	43%	28%	27%
Congo, Democratic Republic	45%	28%	21%
Côte d'Ivoire	35%	30%	17%
Egypt	72%	39%	55%
Ethiopia	18%	62%	9%
Kenya	46%	37%	25%
Morocco	49%	51%	33%
Mozambique	34%	27%	39%
Nigeria	53%	32%	24%
Sierra Leone	21%	60%	54%
South Africa	57%	24%	46%
Tanzania	20%	45%	43%

Table 3 below also provides a summary of PEST analysis for Somalia and Kenya making some basic comparisons.

In relation to those perspectives, some separate analysis for the political, economic, social and technological outlooks is provided, as well as some conclusions whether these factors have a major impact to the lagging behind of these countries' mobile networks. In respect to more analysis the questionnaire and investigations as well as other sources of the research will be referred to in the conclusions.

Table 3. PEST Analysis Kenya and Somalia. (Strategic Analysis Tools 2007)

PEST factors	Kenya	Somalia
Political Analysis	*Government type:* Republic	*Government type*: Republic
	Legal system: Mix of English common laws, Islamic and customary laws	*Legal system:* Mix of English civil laws, Islamic and customary law
	Legislative branch: Parliamentarian (president, parliament and judiciary)	*Legislative branch:* Parliamentarian (president, parliament and judiciary)
	Political stability: Quite stable African young democracy until 2007 election crises. The crises have been resolved by power sharing of the government.	*Political stability:* Politically stable before 1977 Somalia and Ethiopia war. Country experienced a civil war 1990-2008. Country has a huge challenge in state building and development.
Economic Analysis	From an economic advancement's point of view Kenya has been making substantial growth of 5% in recent years. Economic growth is expected to continue.	Somalia has been experiencing significant growth for several years. The country's economy growth is expected to accelerate in the future.
Social and Cultural Analysis	Population consists of various ethnic groups from various religious communities. Main languages are Kiswahili and English. As well as in Somalia clans have also a major political power in Kenya.	Population is kept very homogenous with one language and religion. Clan system is very strong in Somalia. Main spoken language is Somali - English and Arabic are also commonly used.
Technological Analysis	Kenya is one of the African countries benefiting from the rise and adoption of ICT equipment as well as the services offered by the today's mobile networks such as banking, mobile money and many e-services.	Somalia's economy has been growing in recent years. A new government has taken control beginning of 2017 as Somalia has been experiencing political recovery for the last several years. Mobile banking and telecom sectors are among most developed in Africa.

Political analysis:

In general, the political environment holds many risks for the telecom sector. Some significant traditional political risks for the telecom sector are the ones related to regulations, network licensing as well as national radio spectrums management and in certain instances national trade barriers as well (Mobile Economy Africa 2016).

Political factors have a huge impact on the network operator's operations though generally they have had less effect on network vendors. In respect to political advancements globally, it was the result of globalization that the telecom industry has been enjoying a relative freedom for past decades. On a political scale, both Kenya and Somalia are relatively liberal countries when it comes to foreign policies as well as regulations affecting the telecom sector (World Bank 2016).

Key findings:

- Politically, Kenya has been stable for the last several decades. The country got its independence from Britain in 1964. The country's telecom sector has been operating relatively well due to privatization over the last two decades.
- Somalia has not been as stable as Kenya since its independence in 1960. Somalia experienced instability from civil wars for two decades in 1990- 2008, the formation of its post war Interim Government took place in 2008. Since that time the country has experienced recovery and is making financial gains. The telecom sector was a driver to Somalia's industry even in the civil war years and was enabling mobile banking as well as employment.
- Kenya and Somalia have been open to investments compared to neighbouring Ethiopia which has a state-owned monopoly telecom industry. The development and service delivery of Ethiopia's networks has been far less than those in Somalia's and Kenya.
- The political analysis of both countries shows some of the reasons why the networks of these countries have been lagging behind particularly in Somalia. Moreover, the ICT development strategies of both countries (literacy, accessibility, affordability, awareness of services and infrastructure building) all have a major interconnection to political decisions and thus have an effect on development and the country's prosperity and technological advances (World Bank 2016; Mobile Economy Africa 2016).

- As a conclusion, both countries have benefited a lot from their private owned mobile telecom industry. Both countries have also witnessed huge developments in their community's developments where mobile networks have been playing a major role. It is also obvious that this has an effect on the countries' mobile networks current status. In relation to the lagging behind reasons are more on the overall developments of the country and their scale and capacity to deliver services and make a growth (World Bank 2016; Mobile Economy Africa 2016).

Economic analysis:

In every country, the role of economic growth is very important for the country's development and prosperity as well as services delivery to its people and wellbeing. It is a major reason for seeking development and why countries gather taxes from almost every possible income source they have. From the perspective of Tables 1 to 3, it is obvious that both Somalia and Kenya are categorized as being part of the developing world (World Bank, 2016; Mobile Economy Africa 2016).

However, as summarized in the tables above, it is apparent that these countries have been making remarkable economic progress in recent years. For instance "Mobile industry generated 6.7% of Africa's GDP and 3.8 million jobs in 2015, a contribution that amounted to around $150 billion of economic value" (The Mobile Economy Africa 2016).

Key findings:

- Economically Kenya and Somalia have been growing, with Kenya progressing more.
- Both countries have been experiencing serious challenges with regard to socioeconomic welfare related to jobs creations, healthcare, education, security and stability.
- Both countries have been experiencing an increase in living costs as well as corruption which have a serious effect to these countries' economic growth.

- On the economic side, it is significant that investments to innovations and renewing infrastructure have been low in both countries (The Mobile Economy 2017; The Mobile Economy Africa 2016-2017). .

Social analysis:

From a social development perspective, access to primary services like education and healthcare are vital to both countries' developments and well-being. Furthermore, social development factors have a huge influence on the countries' mobile industry profitability and investments as well as on other sectors. Social media and the internet have become an everyday life also to many developing countries' residents. Access to technology and know-how also plays a very important role in terms of having access to a skilled workforce. This applies to sophisticated technologies such as efficient mobile networks which could respond to consumer's demands and stay updated. Social and cultural aspects play an important role in the countries' prosperity as well as to their position on the global stage. Moreover, the below key findings have been summarized from the same source as above (World Bank, 2016; The Mobile Economy Africa 2016).

Key findings:

- Both countries have huge social issues such as poverty, accessing primary services of education, health, security issues as well as infrastructure constraints like roads etc.
- Both countries are experiencing population growth as well as the challenges of inflation and growing trends of prices.
- Both countries are committed to developing ICT so that it is accessible to anyone as well as affordable. Even though a clear strategy is yet to emerge from Somalia
- Both countries also have huge social possibilities and human assets to become prospering economies in the future if political progress and stability continues.
- The factors of political, economic, social and technological are perhaps the most important reasons why the networks have been lagging behind.
- The networks as well as to any other human advancement in technology usually depends on the countries' social well-being and status, which also has interconnection to its education, wealth and access to technologies and know-how. This appears to be low in both Somalia and Kenya, even though Kenya is well positioned.

Technological analysis:

From a technological development point of view Kenya has been making significant developments in recent decades as well as Somalia - particularly in the telecom industry. In the bigger picture, the entire telecom industries as well as other ICT-driven sectors which are based on technology advances always depend also on economic developments. This is a central to business and productivity improvements. It is the telecom sector that stands to gain the most from these technological trends and offering opportunities to many communities in the world and in those in the developing countries. Also, technology and technological skills and know-how play a key role in the ability to build a stronger economy (Richard, Florida, The World's Leading Nations for Innovation and Technology 2011).

As the following (Martin Prosperity Institute research figures) Figures 12, 13 and 14 below show, the research and development, technology capacity, scientific research ability and innovations have a ground-breaking effect on a country's development and its ranking economically. Figure 12 below shows the R&D investment weight in relation to economy prosperity (Richard, Florida, The World's Leading Nations for Innovation and Technology 2011).

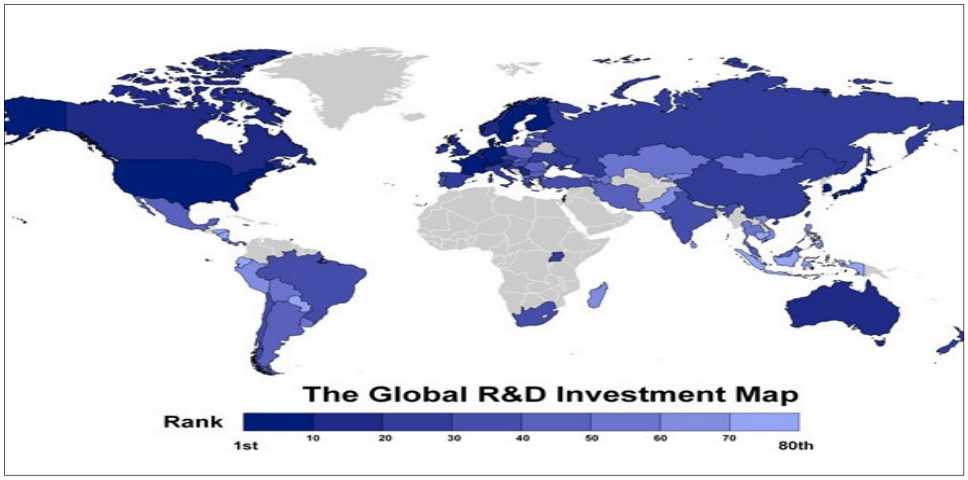


Figure 12. Global R&D Investment Map. (Richard, Florida, The World's Leading Nations for Innovation and Technology 2011)

The research above concerned 82 countries, the research focus concerned three main metrics which have been combined in a new comprehensive Global Technology Index. The three main metrics were

- Research and development efforts
- Scientific and research talent (engineering talent per capita)
- Level of innovation

In Figure 13 below, the darker-coloured areas show countries doing best in technological advancements. The front-running countries include Israel, Sweden, Finland, Japan, and Switzerland which make up the top five, while South Korea, Germany, Denmark, and France round out the top ten. For instance Russia was 22nd, China 26th, Brazil 31st and India 38th and so on. Figure 15 below indicates again the scientific and engineering researchers' per capita meaning the money spent on these activities (Richard, Florida, The World's Leading Nations for Innovation and Technology 2011).

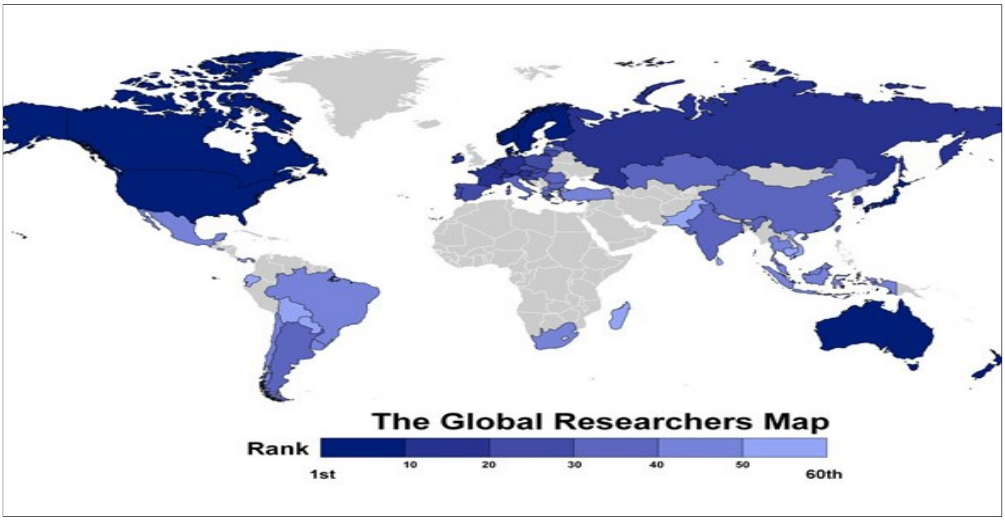


Figure 13. Scientific Research Map. (Richard, Florida, The World's Leading Nations for Innovation and Technology 2011)

Moreover, the Figure 14 below measures the scientific and engineering researchers' per capita. The report shows that Finland ranks number one, followed by Sweden, Japan, Singapore, and Denmark, US, Norway, Australia, Canada, and New Zealand.

Figure 14 below shows innovations patents per capita. In this ranking United States took the first place followed by Switzerland, Finland, and Israel followed by other countries. There is no one African nation in these top rankings, which shows major linkages between technological power and development (Richard, Florida, The World's Leading Nations for Innovation and Technology 2011).

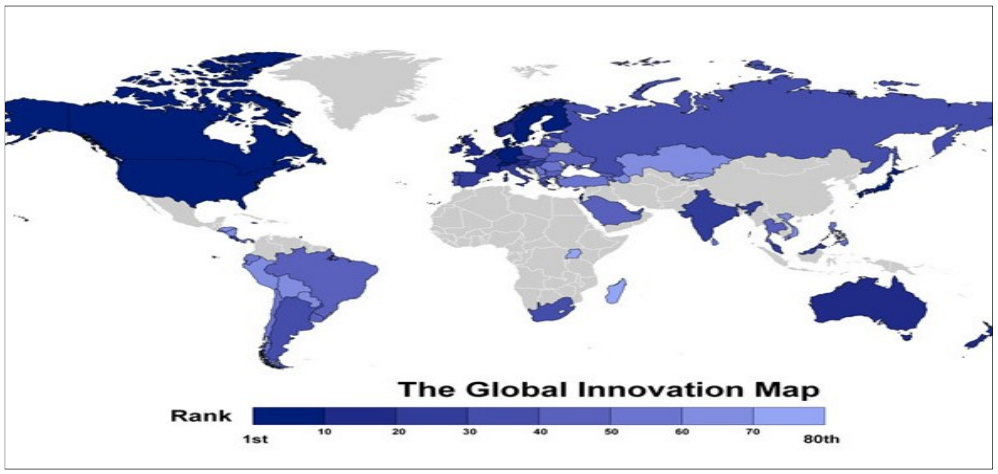


Figure 14. Global Innovation Map. (Richard, Florida, The World's Leading Nations for Innovation and Technology 2011)

The factors of technology, scientific research and innovation combined create a global technology index, a broad assessment of the technological and innovative capabilities of the world's leading nations. In that index, Finland ranks top followed by the United States and Japan. African countries remain mainly underdeveloped and do not show in these indexes (Richard, Florida, The World's Leading Nations for Innovation and Technology 2011).

Key findings:

- It is obvious that both Kenya and Somalia are far behind in technological advances compared to many other countries in the globe.
- It is also obvious that being behind in R&D, innovation and technological advances could cause technological gap, which also has a clear effect on these countries' mobile networks advances as well as efficiency.
- The technological gap appears to be the major factor for Somalia and Kenya when it comes to mobile networks and taking new technologies into use.

- From a spectrum management point of view Kenya is in a good position and the communication authority of Kenya is responsible for managing it.
- On the Somalia side, the telecommunications laws have been lacking and the authorities have not had tools to deal with it. More control is now expected to come as new laws were approved in 2017.

5 RESEARCH INTERVIEWS

The research included a questionnaire as well as some other basic information gathering methods. The questions were designed to elicit answers about mobile networks status as well as service delivery.

When started the thesis in 2013, the concerned operator networks had been lagging behind on 3G deployments as well as 4G LTE planning. The most important aim of the thesis was to get an answer for what were the main barriers, challenges or other reasons that were causing the networks to be lagging behind.

The information gathering for the study also included information collected from two scholars from each country as well as information related to service usages collected from 10 service consumers from each country. The questions and the outcomes of the operator questionnaire are introduced in Table 4 below. Due to business reasons, it was agreed with the operators not to mention their names. Information was mainly collected at the end of 2013; some of data had been updates later on.

5.1 Research Outcomes

The research has included questionnaire and interviews held with operators. Questions were also asked from two scholars from Somalia and Kenya as well as ten service consumers from each country. The Table's 4-7 below consist of questions and their outcomes.

Table 4. Questionnaire outcome

1. *What is the status of your mobile network (2G, 3G, 4G, -LTE) and which is dominant? If possible, please give some percentages.*	
Operator in Kenya	Operator in Somalia
Our network status is mainly 2G, we have plans to deploy 3G services before the end of 2013. The 3G is expected to be tested soon.	Our network is mainly 2 G. We intend to respond to the increasing demand for higher capacity. For this we are planning to deploy 3G services by 2014.
2. *Which are the most common services you offer (Voice, SMS, internet access etc.)? If possible, please give some percentages.*	

Operator in Kenya	Operator in Somalia
Our main drivers are voice and SMS services. We are also gaining some revenue from the slow 2G data services.	Main income comes from voice and SMS.
3. What is the status of your network infrastructure? Does it require any major renewals? If so, please indicate which network needs it (radio network, core network or both).	
Operator in Kenya	Operator in Somalia
Network infra has been under renewal for years. We are trying to upgrade our networks to respond to the consumer's demands. The 3G renewal will be needed to continue and expand.	Our network infra is quite new. We plan to extend it in the near future as well as introduce new services.
4. What was the most growing service(s) for the last 3 years? Please give some percentages.	
Operator in Kenya	Operator in Somalia
SMS service has been growing year after year by 20-30 percent.	SMS has been making growth latest years and is the fastest growing service.
5. There is an argument that Africa's mobile operators particularly in Somalia and in Kenya are several years behind, compared to other continents. This concerns mobile networks infrastructure. Do you agree with that argument? If so, please indicate your thoughts about potential problems or barriers.	
Operator in Kenya	Operator in Somalia
There is no one answer to the question. There are major influencers which could play a key role for networks infrastructure. Some major influencers are for example low investment possibilities, low technological know-how, and financial power of consumers and market for instance. A lagging behind caused by many influencers exists.	This argument is relevant. In Somalia's case we have been experiencing challenges from years of instability. We do not have major international financial institutions. A banking system is currently lacking in Somalia. We think that the issue is connected to access to financing, technology knowledge and social state of development.
6. Do you think there could be any culture-related dependencies or reasons why these networks are behind?	
Operator in Kenya	Operator in Somalia

Well, we could not straight forward say yes or no. What we could say is for example that you need a development in ICT and education to have a community that has a work force, incomes and can afford to subscribe to services. We don't think that there something wrong from the culture, but we do think that society's state of finance and ability has a connection to technological development. There are more economic reasons than cultural.	For this specific cultural issue, we think that there are various challenges that the community is facing. We believe that if the development is low then technological advances will be low. In contrast, if the development and stability are high, we could say that the community has an ability to do well technologically and financially. So there is dependence in that respect. There are no cultural reasons why the networks lag behind.
7. Do you believe the economic status of your county affects operator's capabilities to renew networks?	
Operator in Kenya	Operator in Somalia
That is obvious. Our development is connected to our country's development economy and wellbeing. The development of education, energy, road building, rural community development, ICT infra all need economy and investments. We also need appropriate laws to be emplaced to boost the development. Yes to this question.	That is something clear. The economy and the government role are vital to making major developments and investments. Our community is having challenges in many sectors. Even though the situation has been challenging we have been doing well for the recent years. Yes to this question.
8. What are the existing opportunities in mobile market in your country?	
Operator in Kenya	Operator in Somalia
There are huge opportunities in Kenya for operators and for third-party service providers. There are also opportunities for consumers and for businesses. Furthermore, there are huge opportunities to invest mobile sector for investors, for service providers and for network vendors.	Yes, there are many opportunities for network vendors, for investors, for business, service providers and for agents etc.

Questions and responses from scholars are presented in Table 5 below.

Table 5. Scholars' data

Kenya	**Somalia**
Scholar 1, *question 1:* *What are your views relating to mobile networks developments?* Response: In brief, Kenya's mobile networks have made satisfactory progress in recent years. Mobile network coverage has been expanding as have mobile money solutions. As it's difficult to respond to a technical question, that is my view.	Response: I don't have technical figures, but I could say that networks have been a positive development for the country. It was a major economic driver for the economy as well as a main employer.
Scholar 2, question2: *What are your views related to mobile networks services?* Response: The services of the network are available very well from many agents and resellers. I keep services responding to consumers demands for the time being.	Response: I am satisfied with the services I receive from the network. Service interceptions are rare and prices are convenient. Mobile money has become very popular in the community.

Service consumers' questions and responses are presented in Table 6 for Kenya and in Table 7 for Somalia.

Table 6. Consumer data Kenya

Question 1: Which service do you use mostly? a) voice call, b) SMS, c) Internet Out of ten: 4 Voice 4 SMS 2 Internet		10 consumers replies								
	1	2	3	4	5	6	7	8	9	10
	c	a	b	b	a	b	c	a	b	a
Question 2: How much do you consider your mobile phone important for your daily work? a) important b) not important Out of ten: 8 consider phones important for their work 2 consider them not important	1	2	3	4	5	6	7	8	9	10
	A	a	a	b	a	a	a	a	b	a
Question 3: If you use the internet with your mobile phone which is important for you: just to have connectivity of the internet or to have a high speed connection? a) speed is important b) connectivity is important not speed Out of the 10: 7 considered internet connection speeds important 3 considered internet connection speeds less important	1	2	3	4	5	6	7	8	9	10
	A	b	b	a	a	a	a	b	a	a

Table 7. Consumers data Somalia

Question 1: Which service do you use mostly? a) voice call, b) SMS, c) Internet Out of the: 5 Voice 3 SMS 2 Internet		10 consumers replies								
	1	2	3	4	5	6	7	8	9	10
	a	a	a	b	a	b	c	a	b	b
Question 2: How much do you consider your mobile phone important for your daily work? a) important b) not important Out of ten: 6 considered phones important for their job 4 considered phones not important	1	2	3	4	5	6	7	8	9	10
	a	b	a	b	a	a	a	b	b	a
Question 3: If you use the internet with your mobile phone which is important for you: just to have connectivity of the internet or to have a high-speed connection? a) speed is important b) connectivity is important not speed out of ten: 6 considered internet connection speeds important 4 considered it not important	1	2	3	4	5	6	7	8	9	10
	a	a	b	a	a	b	b	b	a	a

Key analysis to the questions and discussions above:

- Operators from each country Somalia and Kenya show that their networks have been mainly on 2G level in 2013. In Kenya there has been discussions on 3G deployments and in Somalia not mentioned such activities.
- Responses show that SMS and voice has been most common used services and revenue generators to operators.

- Operator's responses also show that the development of the target countries been low compared to countries having advanced technologies and networks.
- Operators have indicated that ICT strategy; improvements on digital literacy and education system, know-how could have a positive impact and help get skilled workers. Scholars have been comfortable with the services they have been receiving and were optimistic to future developments.
- Consumer's point of view, they have been active service users and respected connectivity, SMS as well as voice services.

  The discussions and questionnaire have been informative for the research and were important for the conclusions.

The African development bank report (AfDB 2014) identifies the ICT infrastructure challenges in Somalia as following:

- Security
- Energy
- Self-regulation
- Nomadic Population
- Expensive bandwidth

The Figure 15 below indicates four key ICT priorities in Somalia. The sector holds huge investment opportunities. For ICT infrastructures manufacturers as well as for service producers Somalia has opportunities for them. The figure has been referred from African development bank report of 2014, which has been emailed for the research.

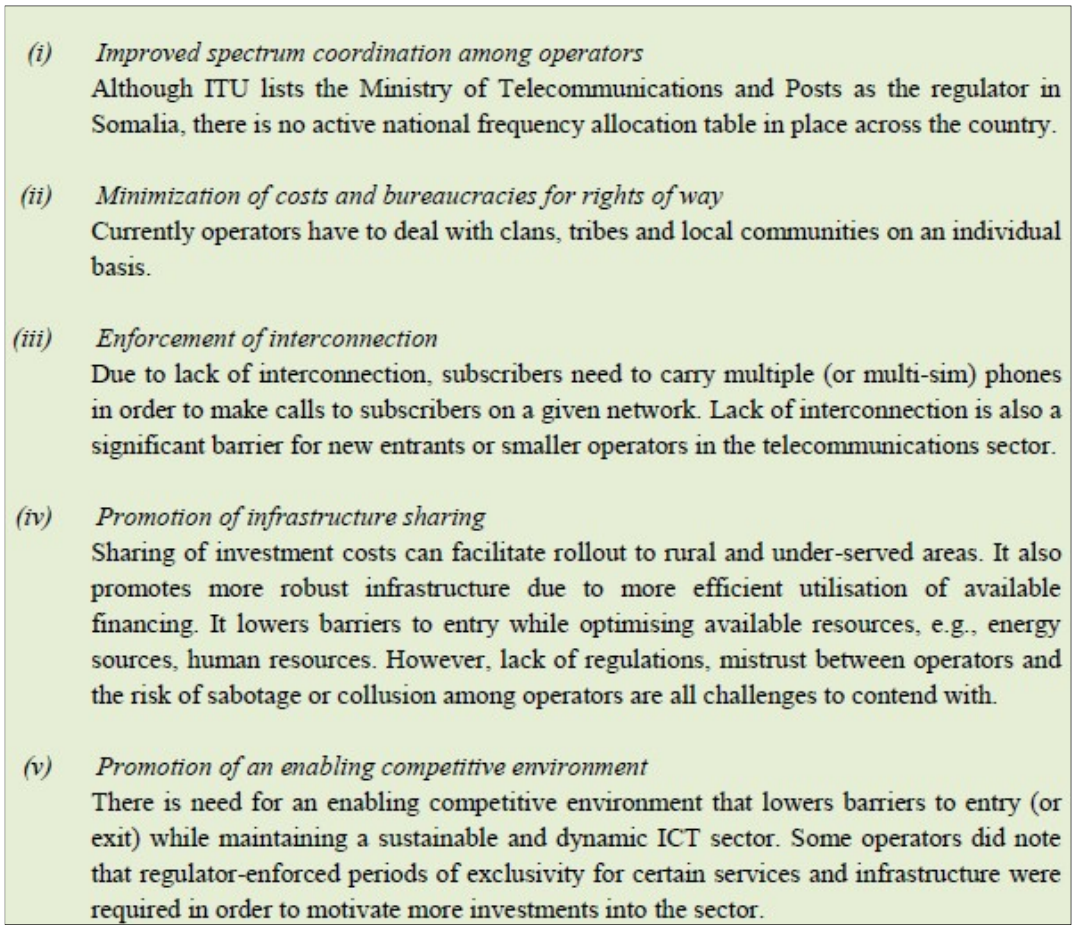
(1) *Development of an ICT Policy and Strategy for Somalia*
- Policy should account for Somalia as a Federal Republic and also clearly outline roles, mandate and responsibilities at State level

(2) *Development of a Regulatory Framework*
- Establishment of independent converged regulator (telecommunications and broadcasting)
- Technical assistance and equipment to establish spectrum management and monitoring units across the country

(3) *Development of a National Broadband Plan*
- The arrival of fiber optic cable to Mogadishu is expected to have a transformative effect on job creation and business development. There is need to spread this broadband connectivity to other parts of the country, preferably through public private partnerships (PPP) and with open access principles.
- There is need to build metro fibre networks to enhance broadband connectivity within cities and towns

(4) *Development of e-strategies*
- Development of e-strategies addressing e-government, e-health, e-agriculture, e-commerce, etc., to drive up demand for the ICT infrastructure
- While a private data centre exists in Mogadishu (established by Dalkom), MIPT seeks assistance to build a government data centre with features including management of a national gateway, hosting of an Internet Exchange Point (IXP), and facilitating interconnection among mobile operators
- Development of policies addressing secure and reliable ICT usage including policies for computer misuse, SIM card registration, data protection, intellectual property rights and cyber-security

Figure 15. Key ICT priorities in Somalia. (AfDB 2014)



(i) *Improved spectrum coordination among operators*
Although ITU lists the Ministry of Telecommunications and Posts as the regulator in Somalia, there is no active national frequency allocation table in place across the country.

(ii) *Minimization of costs and bureaucracies for rights of way*
Currently operators have to deal with clans, tribes and local communities on an individual basis.

(iii) *Enforcement of interconnection*
Due to lack of interconnection, subscribers need to carry multiple (or multi-sim) phones in order to make calls to subscribers on a given network. Lack of interconnection is also a significant barrier for new entrants or smaller operators in the telecommunications sector.

(iv) *Promotion of infrastructure sharing*
Sharing of investment costs can facilitate rollout to rural and under-served areas. It also promotes more robust infrastructure due to more efficient utilisation of available financing. It lowers barriers to entry while optimising available resources, e.g., energy sources, human resources. However, lack of regulations, mistrust between operators and the risk of sabotage or collusion among operators are all challenges to contend with.

(v) *Promotion of an enabling competitive environment*
There is need for an enabling competitive environment that lowers barriers to entry (or exit) while maintaining a sustainable and dynamic ICT sector. Some operators did note that regulator-enforced periods of exclusivity for certain services and infrastructure were required in order to motivate more investments into the sector.

Figure 16. Mobile operators benefits from regulations in Somalia (AfDB 2014)

Moreover, the above Figure 16 lists some important benefits to operators from the sector regulations and how it could promote business and development. Both in Somalia and Kenya, regulations play a major role in the mobile sector as well as in other sectors also to attract investors as well as to develop the sector.

Figure 17 below shows major Somalia mobile money application. EVC mobile money application is the most popular, while other services listed in the figure are also widely (AfDB 2014). Somalia is among the front runners in mobile money services in Africa and worldwide. The mobile money applications came to Somalian and Kenyan early 2000s (AfDB 2014).

Operator	Product Name	Launched	Product Offering
		m-Learning and m-Education	
Golis Telecom, Puntland	Xogmaal		Xogmaal is a high level SMS message: Enquiring; Emailing through a mobile; Searching from largest encyclopedia, dictionaries; Online checking of stock exchange; Currency rate exchange; weather-forecasting, News channels like BBC, Al-Jazeera, CNN and Somalia media.
		Mobile Money	
Golis Telecom, Puntland	Sahal		P2P transfer - Domestic Bill payment Government-to-Person (G2P) Other bulk payment Airtime top up
Hormuud, South & Central Somalia	EVC	2009	Airtime top up
Hormuud, South & Central Somalia	EVC Plus	2011	P2P transfer - Domestic Bill payment Merchant payment Other bulk payment (max US$ 300) Airtime top up
Nationalink, Somalia	e-Maal	September 2011	P2P transfer (Domestic) Other bulk payment Airtime top up Merchant payment
Telesom, Somaliland	Zaad	June 2009	P2P transfer - Domestic Bill payment Merchant payment Other bulk payment Airtime top up International remittances Link to other banking products

Figure 17. Mobile enabled services in Somalia, 2014 (AfDB 2014)

Key findings:

- Both operators have shown that the status of their network was mainly operating on 2G networks, while at the same time many operators around the world have been operating mainly on 3G networks (2013). The operators have admitted being lagging behind in deploying 3G by at least 1-2 years.
- On service delivery point of view, operators have shown that voice and short message SMS have been gaining a major market, even though they had a concern in the future due to free calls applications such as OTT (On-The-Top) Skype, WhatsApp, Viber etc.
- Both operators show a strong opinion that the developments of their business have been interconnected to the development of their community, their incomes and capacity, economic access to investments as well as having peace and

stability. On the social development side both considered as important education, ICT and access to knowledge as keys to development.

- From the consumer's point of view voice and SMS were considered important also in the future, while the Internet was reckoned to be an increasingly important service. Consumers also appreciated services availability, affordability - and mobile banking was considered a very important service.
- The conclusion to the questions is that these markets are dynamic and growing. There has been tough competition in mobile market from customers. These markets also afford huge opportunities from an investment point of view. From the networks status point of view, both operators considered their network to be behind compared to those in the developed countries. A crucial factor mentioned as a reason for this was that the investments have been at too low level. Other reasons mentioned were social, economic and political influences.

Both operators have indicated that they are committed to deploying modern technologies, services as well as to developing their networks to respond to consumers demands.

6 CONCLUSIONS AND RECOMMENDATIONS

The research was productive in many ways. During the research it was possible to travel to these countries and meet people of different groups: youth, elders, politicians as well as operators and service consumers. As a researcher this was an opportunity as well as a chance to investigate the networks status and to find out the reasons why the networks in these countries have been lagging behind developed countries.

6.1 Conclusions

The study focused on investigating two main questions. The first question was why the mobile network's status in East Africa is behind the networks in developed countries. The second question was whether there have been any social or cultural influences that have affected the progress in mobile networks. The following conclusions were noted.

- First, research findings from various sources strengthen the prior knowledge that these networks have been lagging several years compared to those developed. The main answer to this question by an operator from Somalia informed that all is related to cost, the world cost have been mentioned three times in a row. Operator representative mentioned serving a community with a low income and have a substantial number of poor people dealing with daily life. In the comment, it was said being not possible to follow the latest technology when modern technologies are emerging every year or half a year in the market. What is done is that some upgrades are skipped a year or two and the tried to catch the technology with less frequent updates. It was also considered the know how to being a major challenge. One more major implication mentioned from the Somalia side was that the frequencies management and allocations were missing a responsible body.
- Secondly, Somalia and Kenya considered social development and conditions of life, education, health, and infrastructure very important. Also, economic and political situation together with peace and stability were reckoned to be major actors for further development. In response to the second question, all discussions indicate that social concerns increase the gap between developing and developed countries in general and this also has an effect to the status of mobile networks.

- Access to remote areas, getting electricity, skilled workers, having functioning infrastructure of the country has also been mentioned and kept playing a very an important role.

With respect to the main reasons mentioned above the following factors were also emphasized: From the second question's point of view; the data collected and the interviews responses all indicate that there is interdependence between lagging behind in mobile networks evolution and social developments of the countries not only on cultural perspective but also from a socio-economic point of view.

- In this aspect there have been two arguments in the discussions. First, in order to develop the mobile networks, it was indicated that one needs well educated employees, well-structured ICT in the country as well as innovations.
- Second, in order to be able to make investments; it was indicated that one needs both local and international investors as well. It was also clear that the society involved should have potential purchasing power as well as peace and stability.

To conclude, the arguments advocate that the reasons for lagging behind in mobile networks evolution has been mainly due to developmental issues connected to economic and social growth.

6.2 Recommendations

Researching mobile networks evolutions in East Africa was an interesting topic. During the research the author had the chance to discuss with various stakeholders. In doing so, it became increasingly apparent that mobile networks services have been very important to the communities concerned. In addition to the above observations and conclusions, a short list of recommendations can be summarized. They include some points that are important to be highlighted and might interest topic stakeholders as well as researchers.

- The networks in these countries need periodical updates to follow technological trends of the global markets in terms of modern technologies. For this network vendors as well as investors have a space to support and to invest in these markets.
- The political, economic, social and technological barriers need to be dealt with in the countries' policies to reach a sustainable situation making investments and developments possible particularly regulations related to telecommunications sector need to be well serving to the sector.
- Education and acquiring know-how is important to all sectorial developments as well as for operators to get human resource. For these countries need to have priorities on education and technology developments as well as operators need to invest on human resources, trainings, educating their staff etc.
- Mobile networks vendors need to collaborate closely with local operators so that they are aware of networks bottle necks at an early stage.
- Operators also need to partner with vendors they choose so that they can get possible loans or investments to renew networks if the cash is a barrier or seek other solutions for the possible financial constraints.
- Both Somalia and Kenya networks have a huge possibility for further investments and that needs to be underlined by network vendors and service providers.
- In Somalia's case, networks are still under development, roaming is not yet possible, and internet penetration is less than 10%. This shows a huge possibility for this fragile market. From an investment point of view first come first served could apply. Those who go there first may get better deals compared to those who wait for the country to become more stable.

Despite challenges related to developing country's lower level of advancement in technological front. Still these countries hold potential business in the mobile industry as well as on the other sectors like energy, construction, agriculture, finance, fishery and livestock.

During writing this thesis it was a privilege to meet operators from both Kenya and Somalia as well as discuss local people from the telecom services they prefer. People were telling positive views towards networks services; it was also noticeable that these markets have been growing fast. I have visited to both the countries once a year between 2013 and 2017, things have been changing. Services have been more common among even rural areas and notable to see advances and progress also economically.

It's predictable that the mobile industry in these countries will increase at least 10-20% yearly. It could increase even more in Somalia as network coverage is low and broadband connectivity is less than 2% countrywide.

In viewpoint to observations, these markets hold substantial possibilities and opportunities for growth and prosperity. Network vendors could gain a lot from the growth of these markets as well as the software houses. Moreover, in relation to the challenges exist which mainly relate to skilled employees finding, security and stability these are very manageable. It's always important to investigate with whom to partner and it's recommendable to make some feasibility study as well as make a market research. This applies while entering new markets.

It's recommendable for network vendors, investors and software companies to explore this emerging and dynamic market, which holds a great opportunities to explore. In this final stage, it's in place to conclude with idiom ¨**Rome wasn't built in a day**¨. All great things need time to be created. As well opportunities in this countries need to be explored and have a courage be there where opportunities and possibilities now and in the future.

References

Admin in Strategy. (2011). PEST Analysis, CrackMBA, [online]. URL: http://crackmba.com/pest-analysis/ [Accessed 11 November. 2017]

Blycroft Publishing. (2015) Somalia Mobile & Fixed Network Operators list. Africa & Middle East Telecom-Week, [online]. URL: https://www.africantelecomsnews.com/Operators_Regulators/List_of_African_fixed_and_mobile_telcos_Somalia.html [Accessed 10 Nov. 2017]

Banque Africaine De Developpment – African Development Bank. (2014). Needs assessment of ICT in Somalia, Final report – July, 2014 [pdf-sent by email 20 Sept, 2017]

Abhijeet, Pratap. (2017). Telecom Industry PEST/PESTAL analysis. Cheshnotes, [online]. URL: https://www.cheshnotes.com/2017/03/telecom-industry-pestelpestle-analysis/ [Accessed Oct 01. 2016].

Communication Authority of Kenya. (2016). Second Quarter Statistics Report for the Financial year 2016/2017 (October-December 2016). [pdf] Nairobi, Kenya: Communication Authority of Kenya URL: http://www.ca.go.ke/images/downloads/STATISTICS/Sector%20Statistics%20Report%20Q2%20FY%202016-17.pdf [Accessed 15 Nov. 2017].

Country economy. (2017). Country comparison Kenya vs Somalia. Country economy, [online]. URL:https://countryeconomy.com/countries/compare/kenya/somalia [Accessed 10 Nov. 2017].

Deloitte Kenya. (2016). Kenya Economic Outlook, 2016 the story behind the numbers. [pdf] Nairobi, Kenya: Nairobi, Kenya: Deloitte URL: https://www2.deloitte.com/content/dam/Deloitte/ke/Documents/tax/Economic%20Outlook%202016%20KE.pdf [Accessed 5 December. 2016].

GSMA. Understanding 5G, 2014. [online]. UK, London: GSMA Intelligence. URL: https://www.gsmaintelligence.com/research/?file=141208-5g.pdf&download. Last accessed 7 of December 2016.

GSMA. (2017) . The Mobile Economy 2017, [pdf]. URL:https://www.gsmaintelligence.com/research/?file=9e927fd6896724e7b26f33f61db5b9d5&download [Accessed 12 Nov. 2017].

GSMA. (2016). The Mobile Economy Africa 2016. [pdf] UK, London: GSMA Intelligence. URL:https://www.gsmaintelligence.com/research/?file=3bc21ea879a5b217b64d62fa24c55bdf&download [Accessed 8 Dec. 2016].

ITU, International Telecommunication Union. (2003). The evolution to 3G mobile - status report, [online]. URL:https://www.itu.int/itunews/issue/2003/06/thirdgeneration.html [Accessed 10 Nov. 2017].

Jeff, Armstrong. (2013). Powerpoint SWOT, PEST and PORTERS Workshop Brainstorm packBusiness Docs. Business Documents UK, [online]. URL: https://business-

docs.co.uk/downloads/powerpoint-swot-pest-and-porters-workshop-brainstorm-pack/ [Accessed 11 Nov. 2017]

MindTools. (2015). PEST analysis, [online]. URL: https://www.mindtools.com/pages/article/newTMC_09.htm [Accessed 10 Nov. 2017].

Ovum. (2015). Africa Market Outlook, 2015, Africa to have 1 billion mobile broadband subscriptions by 2020, [online]. Ovum Consulting, [online]. URL: http://info.ovum.com/uploads/files/Africa_Market_Outlook_report_November_2015.pdf [Accessed 20 Oct, 2016].

Paul, Budde. (2017). Somalia - Telecoms, Mobile and Broadband - Statistics and Analyses. Research and Markets, [online], USA, URL: https://www.researchandmarkets.com/reports/3822229/somalia-telecoms-mobile-and-broadband [Accessed 10 Nov. 2017].

Richard, Florida. (2011). The World's Leading Nations for Innovation and Technology. CityLab. [online]. URL: https://www.citylab.com/life/2011/10/worlds-leading-nations-innovation-and-technology/224/ [Accessed 08 Nov. 2017].

Stuart D, Little. (2012). Mobile Network Modernization in Africa. Aviat Networks, [online]. URL: http://blog.aviatnetworks.com/the-industry/mobile-network-modernization-in-africa/ [Accessed 7 Oct. 2017].

Stuart D, Little. (2012). Mobile Network Modernization in Africa. Aviat Networks, [online]. URL: http://blog.aviatnetworks.com/the-industry/mobile-network-modernization-in-africa/ [Accessed 7 Oct. 2017].

Safaricom. (2016). News Release, 2016, [online]. Nairobi, Kenya: URL: https://www.nse.co.ke/listed-companies/company-announcements.html?download=8961%3Asafaricom-limited-full-year-results-for-the-period-ended-31st-march-2016 [Accessed 3 Aug. 2016].

Twinpine network. (2016). Mobile Trends Report, Kenya 2016. [pdf] Nigeria, Lagos: URL: http://twinpinenetwork.com/wp-content/uploads/2016/10/Kenya-Mobile-Trends-Report-2016.pdf. Last accessed 20 of November 2016

UNDP. (2017). United Nations Development Program. [online]. URL: http://hdr.undp.org/en/content/human-development-index-hdi [Accessed 10 Nov. 2017].

United Nations (2017). 17 Sustainable Development Goals [online]. URL: https://www.eda.admin.ch/post2015/en/home/agenda-2030/die-17-ziele-fuer-eine-nachhaltige-entwicklung.html [Accessed 02 Oct, 2017].

World Development Report. (2016). Digital Dividends, [pdf] Washington DC, USA: The World Bank; 2016. International Bank for Reconstruction and Development. URL: http://documents.worldbank.org/curated/en/896971468194972881/pdf/102725-PUB-Replacement-PUBLIC.pdf [Accessed 10 Nov. 2017].

Appendix 1: Mobile Networks Evolution 1G to G5

Table – Mobile networks evolution as for.

Generation	Speed	Technology	Period	Primary service
1G	14.4 Kbps	AMPS,NMT, TACS	1970-1980	Voice only, no commercial applications for the public
2G	9.6/ 14.4 Kbps	TDMA,CDMA	1990-2000	Multiple users on a single channel via multiplexing. Network offered roaming, data along with voice
2.5G	171.2 Kbps 20-40 Kbps	GPRS	2001-2004	Internet becomes popular, data more relevant. Multimedia services and streaming, web browsing
3G	3.1 Mbps 500-700 Kbps	CDMA 2000 (1xRTT, EVDO) UMTS, EDGE	2004-2005	Video call and streaming, faster internet access, portability across different device types
3.5G	14.4 Mbps 1-3 Mbps	HSPA	2006-2010	Higher data throughput
4G	100-300 Mbps 3-5 Mbps 100 Mbps (Wi-Fi)	WiMax LTE Wi-Fi	2011 -	High definition streaming, data throughput possible, new phones with HD capabilities supported. Portability, roaming increased
5G	Probably Gbps	Not Yet Soon	(probably 2020)	Expected by 2020, predicted to offer fast data connections in Gigabits and gives boost the internet of things

Source: http://www.kosbit.net/evolution-mobile-networks-1g-2g-3g-4g-5g/

Appendix 2: Sustainable Development Goals (SDGs) for 2015 – 2030

The 17 Sustainable Development Goals (SDGs), with their 169 targets, form the core of the 2030 Agenda. They balance the economic, social and ecological dimensions of sustainable development, and place the fight against poverty and sustainable development on the same agenda for the first time.

Table the UN - Sustainable Development Goals set for 2015-2030.

Goal 1.	End poverty in all its forms everywhere
Goal 2.	End hunger, achieve food security and improved nutrition and promote sustainable agriculture
Goal 3.	Ensure healthy lives and promote well-being for all at all ages
Goal 4.	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
Goal 5.	Achieve gender equality and empower all women and girls
Goal 6.	Ensure availability and sustainable management of water and sanitation for all
Goal 7.	Ensure access to affordable, reliable, sustainable and modern energy for all
Goal 8.	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
Goal 9.	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
Goal 10.	Reduce inequality within and among countries
Goal 11.	Make cities and human settlements inclusive, safe, resilient and sustainable
Goal 12.	Ensure sustainable consumption and production patterns
Goal 13.	Take urgent action to combat climate change and its impacts
Goal 14.	Conserve and sustainably use the oceans, seas and marine resources for sustainable development
Goal 15.	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
Goal 16.	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
Goal 17.	Strengthen the means of implementation and revitalize the global partnership for sustainable development

Source: https://www.eda.admin.ch/post2015/en/home/agenda-2030/die-17-ziele-fuer-eine-nachhaltige-entwicklung.html

Appendix 3: Somalia and Kenya telecom sector comparison

Table compares Somalia and Kenya telecommunication industry.

Telephones - main lines in use	**Total subscriptions:** 85,496 **subscriptions per 100 inhabitants:** less than 1 (July 2015 est.)	**Total subscriptions:** 51,000 **Subscriptions per 100 inhabitants:** less than 1 (July 2015 est.)
Telephones - mobile cellular	**Total:** 37.716 million **subscriptions per 100 inhabitants:** 82 (July 2015 est.)	**Total:** 5.836 million **subscriptions per 100 inhabitants:** 55 (July 2015 est.)
Telephone system	**General assessment:** the mobile-cellular system is generally good, especially is urban areas; fixed-line telephone system is small and inefficient; trunks are primarily microwave radio relay; business data commonly transferred by a very small aperture terminal (VSAT) system **Domestic:** sole fixed-line provider, Telkom Kenya, privatized in 2013 and is now 60% owned by Helios Investment Partners, a London-based equity fund, and 40% owned by the the Kenyan Government; multiple providers in the mobile-cellular segment of the market fostering a boom in mobile-cellular telephone usage with teledensity reaching 80 per 100 persons in 2015 **International:** country code - 254; landing point for the EASSy, TEAMS and SEACOM fiber-optic submarine cable systems; satellite earth stations - 4 Intelsat (2015)	**General assessment:** the public telecommunications system was almost completely destroyed or dismantled during the civil war; private companies offer limited local fixed-line service, and private wireless companies offer service in most major cities, while charging the lowest international rates on the continent **Domestic:** local cellular telephone systems have been established in Mogadishu and in several other population centers with one company beginning to provide 3G services in late 2012 **International:** country code - 252; Mogadishu is a landing point for the EASSy fiber-optic submarine cable system linking East Africa with Europe and North America (2012)
Internet country code	.ke	.so
Internet users	**Total:** 20.952 million **Percent of population:** 45.6% (July 2015 est.)	**Total:** 187,000 **Percent of population:** 1.8% (July 2015 est.)

Source: http://www.indexmundi.com/factbook/compare/kenya.somalia/telecommunications